

WHAT IS CLAIMED IS:

1 1. A method of designing a phase shift mask, the method
2 comprising:
3 identifying edges of a first phase region of a phase shifting
4 mask, the first phase region being located proximate a critical poly region
5 and the identified edges not being edges of the first phase region adjacent
6 to the critical poly region;
7 expanding the identified edges to define a narrow line along
8 the edges of the first phase region; and
9 forming a phase region boundary in the narrow line along the
10 edges of the first phase region.

1 2. The method of claim 1, further comprising:
2 identifying edges of a phase 180 region of a phase shifting
3 mask, the phase 180 region being located proximate a critical poly region
4 and the identified edges not being edges of the phase 180 region adjacent
5 to the critical poly region;
6 expanding the identified edges to define a narrow line along
7 the edges of the phase 180 region; and
8 forming chrome in the narrow line to form a chrome
9 boundary along the edges of the phase 180 region.

1 3. The method of claim 1, further comprising:
2 assigning phase polarities to phase regions;
3 defining edges of the assigned phase regions;
4 establishing a boundary around the added edges; and
5 assigning area outside of the established boundary to have
6 phase zero.

1 4. The method of claim 3, wherein the phase areas are assigned a
2 phase angle of either 0 or 180.

1 5. The method of claim 4, further comprising generating a trim
2 mask to remove undesired patterns between phase 0 and phase 180
3 regions.

1 6. The method of claim 1, wherein the narrow line has a width
2 of a minimum gate width dimension.

1 7. The method of claim 1, further comprising defining a
2 boundary around edges of a second phase region, wherein the edges are
3 not adjacent the critical poly region.

1 8. The method of claim 7, wherein defining the boundary
2 includes defining a boundary around edges having phase 0.

1 9. The method of claim 1, further comprising defining break
2 locations where phase transitions are most likely to occur.

1 10. The method of claim 9, wherein the break locations have a
2 width that permits patterning and inspection.

1 11. The method of claim 1, further comprising generating a trim
2 mask to remove undesired patterns between first and second phase
3 regions.

1 12. A method of generating phase shifting patterns to improve
2 the patterning of gates and other layers needing sub-nominal dimensions,
3 the method comprising:
4 defining critical gate areas;
5 creating phase areas on either side of the critical gate areas;

6 assigning opposite phase polarities to the phase areas on
7 either side of the critical gate areas;
8 enhancing phase areas with assigned phase polarities;
9 defining break regions where phase transitions are likely to
10 occur;
11 generating polygons to define other edges and excluding the
12 defined break regions; and
13 constructing a boundary region outside of phase 0 regions to
14 form a phase shift border.

1 13. The method of claim 12, further comprising:
2 correcting design rule violations; and
3 applying optical proximity and process corrections to phase
4 regions to allow proper pattern generation.

1 14. The method of claim 12, further comprising generating a trim
2 mask to remove undesired patterns between phase 0 and phase 180
3 regions outside of a desired pattern.

1 15. The method of claim 14, wherein the generating is done by
2 oversizing boundary and break regions.

1 16. The method of claim 14, wherein the chrome border has a
2 width of a distance between phase 0 and phase 180 regions.

1 17. A method of enhancing clear field phase shift masks with a
2 chrome border around outside edges of phase 0 and phase 180 regions,
3 the method comprising:

4 assigning phase polarities to phase areas, the phase areas
5 including first phase areas and second phase areas;
6 defining edges of the assigned phase areas;

7 establishing a first boundary around the added edges of the
8 first phase area;
9 forming a chrome border in the first boundary around the
10 first phase area;
11 establishing a second boundary around the added edges of
12 the second phase area; and
13 forming a phase shift border in the second boundary around
14 the second phase area.

1 18. The method of claim 17, wherein adding edges to the
2 assigned phase areas includes defining break regions where phase
3 transitions occur and generating polygons including edges but excluding
4 break regions, wherein the polygons are merged with the assigned phase
5 areas.

1 19. The method of claim 17, further comprising generating a trim
2 mask to remove undesired patterns between the first and second phase
3 areas.

1 20. The method of claim 19, wherein the trim mask does not
2 cover all or any of the phase shift border in the second boundary around
3 the second phase area.

1 21. The method of claim 19, wherein the generating is done by
2 oversizing the boundary and break regions.

1 22. A mask configured for use in an integrated circuit
2 manufacturing process, the mask comprising:
3 a critical poly section defined by first edges of a phase zero
4 region and first edges of a phase 180 region;
5 a first chrome boundary region located outside second edges
6 of the phase 180 region, the second edges of the phase 180 region being

7 different than the first edges of the phase 180 region, wherein the
8 chrome boundary region includes an opaque material; and
9 a second chrome boundary region around second edges of
10 the phase 0 region, the second edges of the phase 0 region being
11 different than the first edges of the phase 0 region.

1 23. The mask of claim 22, further comprising a region outside of
2 defined areas having a phase of zero.

1 24. The mask of claim 22, wherein the second boundary region
2 includes an opaque material.